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(54) **X-RAY CT SCANNER**

(57)Abstract:

PROBLEM TO BE SOLVED: To generate the three-dimensional tomographic images in a desired direction of an interested region without moving a subject by gathering projection data successively detected by a two-dimensional X-ray detection means, computing three-dimensional tomographic image data from the gathered projection data and generating the tomographic image of a desired slice position.

SOLUTION: At the time of tomography, the subject is placed at a position for radiating X-rays to the interested area of the testee body between a scanning type X-ray source 2 and a two-dimensional X-ray detector 5 first. Then, the X-rays are radiated from the X-ray elements 1... of the scanning type X-ray source 2 and X-ray signals are detected in the detectors 4... of the two-dimensional X-ray detector 5. Then, digitized projection data are transferred to a data gathering part 9 and stored, and in the case that the X-rays are radiated from all the X-ray elements 1 and scanning is ended, the obtained projection data are read, three-dimensional data for which the surface of the X-ray source 2 is an upper surface and the surface of the X-ray detector 5 is a bottom surface are arithmetically processed, the slice position is specified by an indication part 15 while looking at a display part 12 and the desired tomographic image is displayed.

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CLAIMS

[Claim(s)]

[Claim 1] The scanning X line source in which the X-ray radiant point which emits an X-ray is prepared possible [a two-dimensional scan], The two-dimensional X-ray detection means which is arranged so that analyte may be made to intervene between said scanning X line sources, it may be installed and the X-ray radial plane of said X-ray radiant point may be countered and in which a two-dimensional scan is possible, The scan control means made to scan so that sequential radiation of the X-ray may be carried out from the X line each radiant point of said scanning X line source, X-ray CT scanner equipment with which said two-dimensional X-ray detection means is characterized by providing a data collection means to collect the detected projection data one by one, and a tomogram generation means to calculate the tomogram data of a three dimension from said collected projection data, and to generate the tomogram for a desired slice location.

[Claim 2] The scanning X line source in which the X-ray radiant point which emits an X-ray is prepared possible [a two-dimensional scan], The support means supported movable, maintaining [connect so that a two-dimensional X-ray detection means to output the X-ray signal based on the X-ray which carried out incidence, the X-ray radial plane of said scanning X line source, and the plane of incidence of said two-dimensional X-ray detection means may counter, and] an opposite condition, The scan control means made to scan so that sequential radiation of the X-ray may be carried out from the X line each radiant point of said scanning X line source, A data collection means to collect the projection data which said two-dimensional X-ray detection means detected, A tomogram generation means to generate the tomogram data of a three dimension from said collected projection data, and to obtain the tomogram for a desired slice location, X-ray CT scanner equipment characterized by approaching from at least 3 directions being possible to the analyte which intervenes between said scanning X line source which possesses and is supported by said support means, and said two-dimensional X-ray detection means.

[Claim 3] The X-ray radiant point of said scanning X line source is claim 1 characterized by emitting a flabellate form or a conic X-ray, and X-ray CT scanner equipment according to claim 2.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention makes an X-ray scan (scan), and relates to the X-ray CT (Computer Tomography) scanner equipment which performs tomography of analyte, does not have a gantry, but relates to the X-ray CT scanner equipment in which tomography is possible, without moving the analyte under processing.

[0002]

[Description of the Prior Art] Conventional X-ray CT scanner equipment arranges analyte between the X-ray tubes and detectors which are arranged face to face, makes an X-ray scan to analyte, and is performing tomography of the area of interest which projected the X-ray on the analyte. As this scan method, there are an approach of rotating analyte and collecting projection data, and a method of rotating the surroundings of analyte for an X-ray tube and a detector in one, and collecting projection data greatly.

[0003] When human being was generally made into analyte so that it may be indicated by JP,7-67445,A, analyte was put to sleep on the berth, it put in in the gantry equipped with a pivotable X-ray tube and a pivotable detector, analyte was moved the whole berth, and the tomogram for an area of interest was reconfigurated.

[0004] The X-ray tube which irradiates an X-ray at a flabellate form, and the detector arranged at the sector are made to counter in the X-ray tube of this gantry, and arrangement of a detector, and it arranges, many detectors are arranged so that it may be close on the method which rotates the surroundings of analyte in one, and the periphery which encloses analyte, and there is a method which rotates one X-ray tube which irradiates an X-ray at a wide angle flabellate form 360 degrees the surroundings of analyte. In recent years, many methods which only an X-ray tube rotates from shortening of precision and scanning time amount are used.

[0005] Moreover, without using the gantry indicated by JP,6-217964,A, the raster scan of the X-ray is carried out, and there is X-ray image equipment which takes a photograph. This equipment makes

an electron beam collide with a conductive anode electrode, makes an X-ray emit, made the X-axis and Y shaft orientations carry out the sweep scan of that electron beam with a beam deflection vessel, and is equipped with one small detector which does not move to the scan X line source (or scan X-ray tube) which generates the X-ray to scan, and the location which counters on both sides of analyte.

[0006]

[Problem(s) to be Solved by the Invention] In performing tomography, the conventional X-ray CT scanner equipment mentioned above must put in analyte in a gantry.

[0007] By making this analyte into a patient, whenever it performed that tomography to check processing performed during the operation if the example which underwent the operation **** was assumed, checking by tomography, the operation had to be interrupted, the patient had to be moved, and it had to put into the gantry. The tooth space in a gantry was also restricted, and if it did not remove since the medical equipment used for the operation became obstructive when moving a patient into a gantry, it was generated also when it was not able to move.

[0008] Therefore, it was difficult to check the processing part by tomography, it having been obliged to interruption of the processing performed to analyte from the tooth-space-problem by the gantry with X-ray CT scanner equipment equipped with the conventional gantry at every tomography, and performing smooth processing to analyte.

[0009] Moreover, the X-ray image equipment in which a raster scan is possible detected the X-ray radiant point indicated by JP,6-217964,A only with one small detector, and although it had the high resolution (high resolution) which expands the area of interest of a small region, only the two-dimensional image was able to be obtained.

[0010] Then, this invention abandoning a gantry, being equipped with sufficient tooth space for the perimeter of analyte, and processing to a test subject, it obtains without migration of analyte the tomogram for a direction which photos and asks for the fault data of the three dimension of an area of interest, and aims at offering the X-ray CT scanner equipment which can check the present condition.

[0011]

[Means for Solving the Problem] The scanning X line source in which the X-ray radiant point which emits an X-ray is prepared possible [a two-dimensional scan] in order that this invention may attain the above-mentioned object, The two-dimensional X-ray detection means which is arranged so that analyte may be made to intervene between said scanning X line sources, it may be installed and the X-ray radial plane of said X-ray radiant point may be countered and in which a two-dimensional scan is possible, The scan control means made to scan so that sequential radiation of the X-ray may be carried out from the X line each radiant point of said scanning X line source, Said two-dimensional X-ray detection means offers the X-ray CT scanner equipment which consists of a

data collection means to collect the detected projection data one by one, and a tomogram generation means to calculate the tomogram data of a three dimension from said collected projection data, and to generate the tomogram for a desired slice location.

[0012] The scanning X line source in which the X-ray radiant point which furthermore emits an X-ray is prepared possible [a two-dimensional scan], The support means supported movable, maintaining [connect so that a two-dimensional X-ray detection means to output the X-ray signal based on the X-ray which carried out incidence, the X-ray radial plane of said scanning X line source, and the plane of incidence of said two-dimensional X-ray detection means may counter, and] an opposite condition, The scan control means made to scan so that sequential radiation of the X-ray may be carried out from the X line each radiant point of said scanning X line source, A data collection means to collect the projection data which said two-dimensional X-ray detection means detected, Generate the tomogram data of a three dimension from said collected projection data, and it has a tomogram generation means to obtain the tomogram for a desired slice location. The X-ray CT scanner equipment which can be approached from at least 3 directions is offered to the analyte which intervenes between said scanning X line source supported by said support means and said two-dimensional X-ray detection means.

[0013] Sufficient tooth space which can be approached is directly born to analyte around the methods of three of the berth which carried analyte, or the methods of four according to the structure where a scanning X line source and a two-dimensional X-ray detector are connected by the base material with the above X-ray CT scanner equipments of a configuration not using a gantry.

[0014] The projection data obtained from the X-ray CT scanner equipment of this invention is three-dimension data, and the tomogram for desired is displayed only by specifying a slice location. Furthermore, the tomogram for the slice cut surface of the slant to which not only a vertical slice cut surface but the include angle was freely set by the directions section to analyte by specifying the starting position of a slice cut surface, a termination location, i.e., the starting position of the X-ray emission of a scanning X line source, and a termination location, and the starting position and termination location of a two-dimensional X-ray detector on the screen of a display is generated.

[0015]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.

[0016] Drawing 1 (a) shows the rough example of a configuration of the 1st operation gestalt of the X-ray CT scanner equipment by this invention.

[0017] This X-ray CT scanner equipment the X wire element 1 which is an X-ray radiant point as it spreads in the shape of a cone, and a flabellate form Two-dimensional [2], for example, the scanning X line source arranged in the shape of a matrix, every ** of the X wire element 1 -- sequential -- two-dimensional -- scanning -- respectively -- since -- so that analyte 11 may be

inserted with the scan control section 3 to which an X-ray is made to emit and it may counter with the X-ray radial plane of the X wire element 1 of the scanning X line source 2 Two-dimensional X-ray detector 5 with which two or more detectors 4 are arranged in the shape of a matrix, The driver section 6 which controls the scan for incorporating projection data from each detector 4 of two-dimensional X-ray detector 5, The amplifier 7 which amplifies the X-ray signal detected by each detector 4, and A/D converter 8 which the amplified output signal is digitized and is outputted as projection data, The data collection section 9 which collects the digitized projection data, and the operation part 10 which generates the tomogram for a desired slice location from collected data, D/A converter 18 which changes into an analog signal the picture signal outputted from operation part 10, The display 12 which displays a tomogram with the changed picture signal, and the printer 13 which carries out the printout of the tomogram, It consists of a control section 14 which controls these configuration parts, the directions section 15 which consists of the keyboard or joy stick which gives directions to this control section 14, and the scanning X line source 2 and the base material 16 supporting two-dimensional X-ray detector 5.

[0018] When the electron beam irradiated from the electron gun and the electron gun carries out the impact of this scanning X line source 2, it consists of X wire elements which consist of a part which emits an X-ray, and the scan control section 3 consists of deflecting system which deflects the electron beam irradiated from the electron gun so that predetermined X wire element may be reached. The X-ray which one of the X wire element of this emitted is emitted to all the detectors 4 of breadth and two-dimensional X-ray detector 5 in the shape of a cone.

[0019] The detector 4 of this two-dimensional X-ray detector 5 is arranged by at least two-line two trains when obtaining projection data as a three dimension. However, although based on analyte, as long as it is good like before at projection data of one line (one scan), the array of an one-line one train is sufficient as a detector 4.

[0020] Moreover, in drawing 1 (a), the scanning X line source 2 and two-dimensional X-ray detector 5 which are connected with a base material 16 are arranged at the character type of KO, or the character type of C so that an opposite condition may be maintained on both sides of analyte 11, but when installing indoors, the scanning X line source 2 may be attached in a head-lining side, and they may attach installation and two-dimensional X-ray detector 5 in a floor side. The scanning X line source 2 may move to parallel to two-dimensional X-ray detector 5 in the range at which an X-ray arrives, may incline, and should just prepare the actuator for it.

[0021] The tomogram for desired is obtained by placing analyte 11 between the scanning X line source 2 and two-dimensional X-ray detector 5, and carrying out imaging processing of the X-ray which emitted and carried out incidence by such configuration, so that an X-ray may be scanned. It is only connected by the base material 16, sufficient tooth space for the perimeter of the methods of three of the berth 17 which carried analyte 11, or the methods of four is produced, and especially the

scanning X line source 2 and two-dimensional X-ray detector 5 can approach analyte directly.

[0022] The condition of having been given by operation, without moving a patient from an operating table, putting a patient on an operating table when analyte 11 uses this operation gestalt for the patient on whom the operation is conducted can be checked, and it becomes possible to carry out without interrupting an operation.

[0023] When it is going to use while conducting an operation for the X-ray CT scanner equipment which obtains a tomogram by the conventional gantry, the tooth space in a gantry is restricted, and in order to move only analyte from an operating table and to usually put in in a gantry, an operation must be interrupted for a certain amount of time amount and photography preparation.

[0024] Moreover, if the medical equipment attached in the patient under operation is not removed, it is generated also when it cannot put in in a gantry and it cannot be removed, X-ray CT scanner equipment can be used.

[0025] Next, with reference to the flow chart shown in drawing 2 , the tomography by this X-ray CT scanner equipment is explained.

[0026] First, analyte is put on the location where an X-ray is emitted to the area of interest which wants to obtain the tomogram for analyte between the scanning X line source 2 and two-dimensional X-ray detector 5. And start one to the scan of the X wire element 1 of the scanning X line source 2, an X-ray is made to emit (step S1), and the projection data which detected the X-ray signal one by one (step S2), digitized it, and was obtained from all the detectors 4 of two-dimensional X-ray detector 5 is transmitted and stored in the data collection section 9 (step S3, S4).

[0027] Next, if it judges (step S5) and has ended [no] whether the X-ray was emitted from the X wire elements 1 of the scanning X line source 2, an X-ray is made to emit from (NO) and the following X wire element 1 (step S6), and return and an X-ray signal are detected to step S2. However, if the scan of all the X wire elements 1 of the scanning X line source 2 is completed (YES), the projection data memorized from the data collection section 9 will be read (step S7), and data processing for generating a tomogram will be performed (step S8).

[0028] What is necessary is to learn a back projection method, the Fourier transform, filter amendment reverse projection, the superimposing method, etc., and just to use either in this invention as an example well-known as this data processing, for example. Detailed explanation of data processing here is omitted.

[0029] Next, the printout of the calculated processing result (tomogram) may be displayed or carried out to a display 12 by the printer (step S9).

[0030] Moreover, it continues and judges whether the scan for obtaining the tomogram for the same area of interest or another area of interest is performed (step S10), and if the tomogram is still more nearly required (YES), return and the same processing will be repeated to step S1, and will be performed to it. however -- if the tomogram is unnecessary -- (NO) -- it is made to end In addition,

what is necessary is just to move either the scanning X line source 2 and two-dimensional X-ray detector 5 or the berth 17 of analyte 11, in order to make another area of interest scan.

[0031] The data of the three-dimensional three dimension which uses the field of the scanning X line source 2 as a top face, and uses the field of two-dimensional X-ray detector 5 as a base with the procedure explained above in a desired area of interest as shown in drawing 1 (b) are obtained. Data processing of this three-dimension data is carried out, and the tomogram for which it asks only by specifying a slice location by the directions section 15 can be displayed, looking at a display 12.

[0032] Here, with reference to drawing 3 (a) - (e), generation of the tomogram by the back projection method in the X-ray CT scanner equipment of this operation gestalt is explained.

[0033] As mentioned above, two or more X wire elements 1 to which the scanning X line source 2 emits an X-ray are arranged in the shape of a matrix. Moreover, two-dimensional X-ray detector 5 with which two or more detectors 4 have been arranged in the shape of a matrix is installed in this and the location which countered.

[0034] As shown in drawing 3 (a), when the punctiform analyte 11 of radiation high absorption tends to be placed and it is going to obtain a tomogram in the meantime, the X-ray emitted to analyte 11 by making three X wire elements 1 into an example on a straight line with the scanning X line source 2 from each X wire element 1a, 1b, and 1c reaches all over the detector 4 of two-dimensional X-ray detector 5. Drawing 3 (b) If it detects by scanning only ****** (X-ray signal) concerning analyte on a corresponding line as shown in - (d), reverse ****** a, b, and c will be obtained.

[0035] As shown in drawing 3 (e), the part with which these reverse ****** a, b, and c lapped turns into the high concentration part 18. Thus, a tomogram can be generated and displayed by the back projection method. Explanation here is omitted although a well-known courier transformation method, filter amendment reverse projection, a convolution method, etc. are applicable to this example besides this back projection method.

[0036] In addition, the scanning X line source 2 makes an electron beam collide with a conductive anode electrode, may make an X-ray emit, may carry out the raster scan of the electron beam with a beam deflection vessel, and may make the scanning point an X-ray radiant point.

[0037] Moreover, two-dimensional X-ray detector 5 may be made to carry out scintillator attachment on the image pick-up side of a solid state image pickup device.

[0038] Next, the 2nd operation gestalt is explained with reference to drawing 4 and 5.

[0039] Although the data of the three-dimensional three dimension which uses the field of the scanning X line source 2 as a top face, and uses the field of two-dimensional X-ray detector 5 as a base had been obtained with the 1st operation gestalt mentioned above, data collection will take [the case where he wants to observe the tomogram only for a certain location, and] time amount to generate the tomogram for the same slice location again.

[0040] Moreover, since the amount of exposures of the X-ray to the same area of interest increases

when the tomogram for the same slice location may be repeated, if it is the scan of the X-ray of only a slice location, the amount of exposures can be stopped low.

[0041] then -- a book -- operation -- a gestalt -- **** -- drawing 4 -- (-- a --) -- being shown -- as -- a display -- 12 -- a screen -- a top -- directions -- the section -- 15 -- a slice cut surface -- a starting position -- termination -- a location -- namely, -- a scanning-type -- X -- a line source -- two -- X -- a wire element -- one -- a starting position -- A -- and -- termination -- a location -- B -- two-dimensional -- an X-ray detector -- five -- a detector -- four -- a starting position -- A -- ' -- and -- termination -- a location -- B -- ' -- specifying -- things -- needing -- a tomogram -- repeatedly -- it can obtain -- .

[0042] The tomogram for the slanting slice cut surface where the include angle as shown not only in a vertical slice cut surface but in drawing 4 (b) to analyte was set up freely can be obtained by specifying these starting positions A, A' and the termination location B, and B', respectively. Moreover, it is not necessary to complement a tomogram for a short time, and, according to this operation gestalt, the image of a high resolution is obtained.

[0043] With reference to the flow chart shown in drawing 5 , generation of the tomogram by the random scan of this operation gestalt is explained.

[0044] Here, the data of a three dimension should already have been obtained. For example, as a patient who is conducting an operation for analyte, X linear scanning of an area of interest is performed first, and the tomogram for desired is generated. When dealing with an operation furthermore and observing the tomogram for the same slice location, the desired scan starting position and desired scan termination location of a tomogram are specified, operating the directions section 15 and looking at the display screen of a display 12 first, (step S11).

[0045] Next, an X-ray is emitted from X wire element in the specified scan starting position (step S12). The X-ray which penetrated analyte 11 is emitted all over the detector 4 of two-dimensional X-ray detector 5, scans each detector 4, carries out sequential detection of the X-ray signal (step S13), and transmits and stores in the data collection section 9 the projection data which might be digitized (step S14).

[0046] Next, if it judges whether the X-ray was emitted (step S15) and has not ended to the X wire element 1 of the specified scan termination location, an X-ray is made to emit from (NO) and the following X wire element 1 (step S16), and return and an X-ray signal are detected to step S13. However, if the scan for tomogram 1 screen is completed (YES), the projection data for one screen memorized from the data collection section 9 will be read (step S17), and data processing for generating a tomogram will be performed (step S18).

[0047] What is necessary is to learn a back projection method, the Fourier transform, filter amendment reverse projection, the superimposing method, etc., and just to use either in this invention as an example well-known as this data processing, for example. Explanation of data

processing here is omitted.

[0048] Next, the printout of the calculated processing result may be displayed or carried out to a display 12 by the printer 13 (step S19).

[0049] Moreover, it judges whether the scan for obtaining a new tomogram continuously is performed (step S20), and if a new tomogram is required (YES), return and the same processing will be repeated to step S1, and will be performed to it. however -- if a new tomogram is unnecessary -- (NO) -- it is made to end

[0050] With this operation gestalt, when generating the tomogram for the same slice location continuously, assignment actuation of a slice location can be omitted and aging of analyte can be easily obtained as a tomogram. The display of such a tomogram is used for the operation which removes a neoplasm, by easy actuation, can repeat and observe the condition of the newest analyte in a short time, and can use it for decision whether it was removed thoroughly for it.

[0051] Next, with reference to drawing 6 , the 3rd operation gestalt of the X-ray CT scanner equipment by this invention is explained.

[0052] Two tomograms had to be compared and discovered with the operation gestalt mentioned above to check the part which carried out aging in analyte when the tomogram for the same slice location was obtained continuously. Discovering especially the change for a short time needs skill, and it is not easy.

[0053] With this operation gestalt, as shown in drawing 6 (a), the tomogram A for the 1st sheet which carried out tomography to time of day t1 is memorized as projection data T1, next it memorizes as projection data T2 of the tomogram B which carried out tomography to the time of day t2 after time amount progress of arbitration and which was obtained at it in the same slice location as Tomogram A.

[0054] And the tomogram which shows only the amount of aging is obtained by searching for the difference of projection data T2 to the projection data T1, and generating the projection data of the difference. That is, the projection data of an analyte part with which change is not seen even if it carries out arbitration time amount progress is removed, and only the changeful part is displayed on a display.

[0055] Moreover, if the number of sheets which sets up the time-of-day setting out t as an arbitration time interval, and carries out tomography is set up, the tomogram as which only the part which changed in the same slice location is displayed can be obtained continuously.

[0056] An example of a table which stores projection data is shown in drawing 6 (b). It divides and stores in the location (x y) of the X wire element 1 which emits the X-ray of the scanning X line source 2, the location (X, Y), and projection data T1 and T2 of the detector 4 of two-dimensional X-ray detector 5 which detects an X-ray on this table.

[0057] With reference to the flow chart shown in drawing 7 and drawing 8 , the tomography of the

tomogram in this operation gestalt is explained.

[0058] First, the directions section 15 performs initial setting (step S21). As initial setting, the time interval T and the photography number of sheets (count of photography) n which carry out tomography are set up, and time of day t= 0 and a parameter m= 0 are initialized.

[0059] Next, it judges whether the time interval to which time-of-day t=mT t, i.e., time of day, was set was reached (step S22). If it reaches at the set-up time of day, according to the slice location set up beforehand, an X-ray is emitted along the line specified from the X wire element 1 of the scanning X line source 2, and the projection data for tomogram 1 two-dimensional image is stored in the data collection section 9 (step S23). Next, Parameter m is incremented to m+1 (step S24), and it judges whether the photography number of sheets n to which the new parameter m was set was reached (step S25).

[0060] Here, when the photography number of sheets n is not reached, return and the following tomogram are photoed to (NO) and step S22. However, when the set-up photography number of sheets n is reached, (YES) and the tomogram only for the part in which took and calculated each difference and analyte carried out aging as a tomogram was read from the data collection section 9, respectively (step S26) and having been mentioned above in drawing 6 are generated (step S27). The generated tomogram is displayed on a display 12 (step S28).

[0061] Here, with reference to the flow chart shown in drawing 8 , the tomography by the two-dimensional scan in said step S23 is explained.

[0062] First, start one to the scan of the X wire element 1 of the scanning X line source 2, an X-ray is made to emit (step S31), and the projection data which detected the X-ray signal one by one, digitized it (step S32), and was obtained from the detector 4 of two-dimensional X-ray detector 5 is transmitted and stored in the data collection section 9 (steps S33 and S34).

[0063] Next, it judges whether the X-ray for one screen of a tomogram was emitted from the X wire element 1 on the set-up line (step S35), and if it has not ended, an X-ray is made to emit from (NO) and the following X wire element 1 (step S36), and it returns to step S32, and an X-ray signal is detected again. However, if the scan of the X wire element 1 on the line where the scanning X line source 2 was set up is completed (YES), it will shift to step S24 of drawing 7 .

[0064] Moreover, when the two-dimensional scan is performing tomography of new projection data, it may stand in a row, and the tomogram by which it was read and calculated and the projection data stored in the data collection section 9 before was generated may be displayed.

[0065] Since only the part in which the tomogram for the slice location set up with the time interval for which it asks could be obtained continuously, and the tomogram had a change of analyte with time further according to this operation gestalt as explained above is displayed, the condition of change can be grasped easily.

[0066] Next, with reference to drawing 9 , the 4th operation gestalt of the X-ray CT scanner

equipment by this invention is explained.

[0067] With the 1st operation gestalt mentioned above, the data of the three-dimensional three dimension which uses the whole surface of the scanning X line source 2 as a top face, and uses the whole surface of two-dimensional X-ray detector 5 as a base had been obtained. However, when an actually required area of interest is the small range, unnecessary projection data will also be collected and the processing time also becomes long.

[0068] With this operation gestalt, the tomogram for the direction of slant of the magnitude of arbitration is obtained in the projection data of a three dimension as shown in drawing 9 . Such a tomogram sets up the scanning zones (frame) p and q which set up the spatial range, project the configuration (ROI) on the scanning X line source 2 or each field of two-dimensional X-ray detector 5, and correspond by actuation of the directions section 15, looking at the screen displayed on the display 12.

[0069] Such an operation gestalt can obtain easily the tomogram which inclined aslant within a certain set-up limits in a short time. Moreover, creation of the tomogram which has the volume of a certain range can also be made easy.

[0070] With reference to the flow chart shown in drawing 10 , the tomography of the tomogram in this operation gestalt is explained.

[0071] First, analyte receives, the set-up scanning zone by the slanting, leaning slice cut surface for which it asks is projected on the scanning X line source 2, and a corresponding scanning zone is limited (steps S41 and S42). Similarly, it projects on two-dimensional X-ray detector 5, and a corresponding scanning zone is set up (step S43).

[0072] And start one to the scan of the X wire element 1 within the set-up limits, an X-ray is made to emit (step S44), and the projection data which detected the X-ray signal one by one is transmitted and stored in the data collection section 9 from the detector 4 of two-dimensional X-ray detector 5 (steps S45 and S46).

[0073] Next, if it judges (step S48) and has not ended whether all the X wire elements 1 within the limits set as the scanning X line source 2 were scanned, and the X-ray was emitted, an X-ray is made to emit from (NO) and the following X wire element 1 (step S49), and return and an X-ray signal are detected to step S45. However, if the scan of the X wire element 1 within the set-up limits is completed (YES), the projection data memorized from the data collection section 9 will be read (step S49), and data processing for generating a tomogram will be performed (step S50).

[0074] Next, the calculated processing result is displayed on a display 12 (step S51).

[0075] And it judges whether a tomogram is continuously obtained like the 3rd operation gestalt in the same range as the range set up previously, and if required, return and a scan will be started to step S44. However, if the tomogram for the same range is unnecessary, it will judge whether (NO) and the new range are set up and a tomogram is obtained (step S53), and if required (YES), return

and a new scanning zone will be set as step S41. however -- if unnecessary -- (NO) -- it ends.

[0076] According to this operation gestalt explained above, the tomogram aslant sliced in the range for which analyte asks by easy actuation for a short time can be obtained.

[0077] Next, with reference to drawing 11 , the 5th operation gestalt of the X-ray CT scanner equipment by this invention is explained.

[0078] The scanning X line source 2 and two-dimensional X-ray detector 5 counter, and this operation gestalt is being fixed with the base material 21 of a U character mold, the character type of KO, or the character type of C. Furthermore, the shaft 23 connected with the joint section 22 which rotates a cross direction, and the actuator (not shown) which it is [actuator] rotatable in a longitudinal direction, and makes it move to it vertically and horizontally is attached in the base material 21.

[0079] It can install so that analyte may be put the whole berth by such configuration to analytes, such as a patient who lies on a berth, and the tomogram scanned from all include angles in the range which does not touch analyte can be obtained, without giving a load to analyte.

[0080] Next, with reference to drawing 12 , the 6th operation gestalt of the X-ray CT scanner equipment by this invention is explained.

[0081] this operation gestalt is equipped with the scanning X line source 24, and carries a series of configuration parts, such as a control section 25, a display 26, the data collection section, etc. which were shown in drawing 1 in others, and axle-pin-rake 27 grade attaches it -- having -- migration -- with the free stand section 28 It is movable small X-ray CT scanner equipment which consists of two-dimensional X-ray detectors 30 attached in the stanchion section 29 connected with the stand section 28 at the fastener free [crookedness], and the point of the stanchion section 29.

[0082] Even if this stand section 28 is designed by the height into which the berth where the patient of analyte lies can go caudad and does not move a patient to a laboratory, it can move and use equipment for a sickroom etc. and does not need migration of analyte at all.

[0083] Next, drawing 13 shows the rough example of a configuration of the 7th operation gestalt of the X-ray CT scanner equipment by this invention.

[0084] the 1st two-dimensional X-ray detector which this operation gestalt counters one scanning X line source and this scanning X line source, and is arranged, and the migration prepared among these -- it is X-ray CT scanner equipment equipped with the 2nd free small two-dimensional X-ray detector.

[0085] This X-ray CT scanner equipment X wire element which emits an X-ray so that it may spread in the shape of a cone, and a flabellate form Two-dimensional [31], for example, the scanning X line source of an installation mold arranged in the shape of a matrix, X wire element the whole ** Sequential and the scan control section 32 to which scan two-dimensional and an X-ray is made to emit from each, Two-dimensional X-ray detector 33 which counters with the scanning X line source

31, and is arranged so that analyte may be inserted and with which two or more detectors have been arranged in the shape of a matrix, The driver section 34 which controls the scan for incorporating projection data from each detector of two-dimensional X-ray detector 33, The amplifier 35 which amplifies the X-ray signal detected by each detector, and A/D converter 36 which the amplified output signal is digitized and is outputted as projection data, It has the same function as two-dimensional X-ray detector 33. Two-dimensional X-ray detector 37 of the migration mold which can move freely by small, The driver section 38 which controls the scan of each detector for incorporating projection data from this two-dimensional X-ray detector 37, The amplifier 39 which amplifies the X-ray signal detected by each detector, and A/D converter 40 which the amplified output signal is digitized and is outputted as projection data, The data collection section 41 which collects these digitized projection data, The operation part 42 which obtains the tomogram for a desired slice location from collected data, D/A converter 47 which changes into an analog signal the picture signal outputted from operation part 42, It consists of the display 43 which displays a tomogram, a printer 44 which carries out the printout of the tomogram, a control section 45 which controls these configuration parts, and the directions section 46 which consists of the keyboard or joy stick which gives directions to this control section 45.

[0086] When said two-dimensional X-ray detector 37 is equipped with the marker which consists of lead etc. that cannot penetrate an X-ray and it can be recognized, for example and it is used for it, it can grasp the relative location to analyte with two-dimensional X-ray detector 33. OK, this two-dimensional X-ray detector 37 can be used in order to obtain the tomogram for a local high resolution from installation and the interior of analyte in the insertion section of an endoscope small, or it can be attached in an external detection probe, and can also use the tomogram for a local high resolution for analyte from the allotment outside auxiliary to two-dimensional X-ray detector 33. Moreover, you may also include in the insertion section of an endoscope.

[0087] With reference to the flow chart shown in drawing 14 , the tomography of the tomogram in this operation gestalt is explained.

[0088] First, the directions section 46 is operated and a two-dimensional X-ray detector is chosen (step S61). By this selection, when two-dimensional X-ray detector 33 is chosen, it becomes the same tomography as (step S62) and the operation gestalt mentioned above, two-dimensional X-ray detector 33 is made to emit the X-ray scanned from the scanning X line source 31 (step S63), and one by one, the X-ray signal acquired by the detector of two-dimensional X-ray detector 33 is stored in the data collection section 41, and is read from the data collection section 41 as projection data (step S64).

[0089] The projection data by which reading appearance was carried out is calculated and generated (step S65), and the tomogram for an area of interest is displayed by the display 43 (step S66).

[0090] Moreover, by selection of step S61, when migration mold two-dimensional X-ray detector 37

is chosen, insert (step S67) and this two-dimensional X-ray detector 37 into analyte, or they are assigned. The X-ray scanned two-dimensional from the scanning X line source 31 is emitted to two-dimensional X-ray detector 37 (step S68). One by one, the X-ray signal acquired by the detector of two-dimensional X-ray detector 37 is stored in the data collection section 41, and is read from the data collection section 41 as projection data (step S69). It is similarly displayed on a display 43 that the tomogram for an area of interest calculated, generated and (step S70) mentioned above the projection data by which reading appearance was carried out (step S66).

[0091] Furthermore, by selection of step S61, when [which chooses two-dimensional X-ray detector 33 of an installation mold and two-dimensional X-ray detector 37 of a migration mold] it is operated, first, two-dimensional X-ray detector 33 of an installation mold is chosen (step S71), two-dimensional X-ray detector 33 is made to emit the X-ray scanned from the scanning X line source 31, and the X-ray signal acquired by the detector of two-dimensional X-ray detector 33 is stored in the data collection section 41 one by one (step S72). Subsequently, two-dimensional X-ray detector 37 of the migration mold which is inserted into analyte or is assigned is chosen, incidence of the X-ray emitted from the scanning X line source 31 is carried out with two-dimensional X-ray detector 37, and the X-ray signal acquired by the detector is stored in the data collection section 41 one by one (step S74).

[0092] After such tomography is completed, projection data is read from the data collection section 41 (step S75), the projection data detected with two-dimensional X-ray detector 33 of an installation mold is calculated, and a tomogram is generated (step S76). Subsequently, the projection data detected with two-dimensional X-ray detector 37 of a migration mold is calculated, the tomogram for desired is chosen from these tomograms that generate a tomogram (step S77) (step S78), and the tomogram is displayed on a display 43 (step S66).

[0093] Here, actuation of the tomography by the two-dimensional scan of steps S63, s68, S72, and S74 is equivalent to the process explained with the flow chart of drawing 8 mentioned above.

[0094] With reference to the flow chart shown in drawing 15 , the tomogram for the request of said step S78 is explained about selection.

[0095] In this data selection, the location of two-dimensional X-ray detector 37 in analyte is grasped by the tomogram obtained from two-dimensional X-ray detector 33 (step S81). Here, it judges whether the spatial position of two-dimensional X-ray detector 33 and two-dimensional X-ray detector 37 is in agreement (step S82), and if not in agreement, the tomogram obtained from (NO) and two-dimensional X-ray detector 33 is chosen, and it displays by the display 43 (step S66 of drawing 14). Moreover, if in agreement (YES), the tomogram for the high resolution obtained from two-dimensional X-ray detector 37 will be chosen (step S84), and it will display by the display 43 (step S66 of drawing 14).

[0096] Next, with reference to drawing 16 , the 8th operation gestalt of the X-ray CT scanner

equipment by this invention is explained.

[0097] This operation gestalt is the configuration of having attached the small scanning X line source in the point of an endoscope instead of the two-dimensional X-ray detector attached in the insertion section of the endoscope in the 7th operation gestalt mentioned above.

[0098] The installation scanning X line source 51 which this X-ray CT scanner equipment arranges X wire element which emits an X-ray two-dimensional, and is installed caudad, The scan control section 52 to which scan X wire elements each of the installation scanning X line source 51 two-dimensional, and an X-ray is made to emit from each, The migration scanning X line source section 53 which can move freely from X wire element which is attached in the point of an endoscope 65 and is arranged two-dimensional, The scan control section 54 to which scan X wire elements each of the migration scanning X line source 53 two-dimensional, and an X-ray is made to emit from each, Two-dimensional X-ray detector 55 which counters with the installation scanning X line source 51, and is installed up, The driver section 56 which carries out scan control of the detection by the detector of two-dimensional X-ray detector 55, The amplifier 57 which amplifies the X-ray signal detected by each detector, and A/D converter 58 which the amplified output signal is digitized and is outputted as projection data, The data collection section 59 which collects the digitized projection data, and the operation part 60 which obtains the tomogram for a desired slice location from collected data, D/A converter 66 which changes into an analog signal the picture signal outputted from operation part 60, It consists of the display 61 which displays a tomogram, a printer 62 which carries out the printout of the tomogram, a control section 63 which controls these configuration parts, and the directions section 64 which consists of the keyboard or joy stick which gives directions to this control section 63.

[0099] After having grasped the location of the migration scanning X line source 53 inserted in analyte and making it move to a desired area of interest first by the tomogram obtained by the installation scanning X line source 51 as shown in drawing 17 , the X-ray scanned two-dimensional from the migration scanning X line source 53 is emitted to upper two-dimensional X-ray detector 51. And the X-ray signal acquired by the detector of two-dimensional X-ray detector 51 is stored in the data collection section 59 one by one. The projection data for tomogram 1 stored image is read from the data collection section 59, is calculated, is generated, and it displays on a display 61 as a tomogram for a high resolution.

[0100] With this operation gestalt, although the scanning X line source was attached in the point of an endoscope, external equipment may be assigned in the area of interest of installation and analyte, and a tomogram may be obtained.

[0101] According to this operation gestalt, a scanning X line source can be easily moved to a local area of interest, and it can observe by the high resolution.

[0102] Moreover, the example of 1 configuration of the movable base material 16 is shown in each

in the condition of having made the scanning X line source 2 and two-dimensional X-ray detector 5 in the X-ray CT scanner equipment shown in drawing 1 countering drawing 18 .

[0103] This base material 16 forms the guide sections 71 and 72 which become the scanning X line source 2 and two-dimensional X-ray detector 5 from a guide slot or a guide rail, respectively, and attaches the sliding sections 73 and 74 which fit in possible [sliding]. Furthermore, a certain amount of pivotable revolution section 75 which can be leaned is made to be placed between the sliding sections 73, and the scanning X line source 2 is connected with a stanchion 76 at them. Moreover, the sliding section 74 is connected with two-dimensional X-ray detector 5.

[0104] A parallel displacement can be carried out by such configuration, maintaining the scanning X line source 2 and two-dimensional X-ray detector 5 in the opposite condition. Furthermore, it is also possible to lean the scanning X line source 2 to some extent according to a service condition.

[0105] In addition, the revolution section which was mentioned above in the sliding section 74 may be made to intervene, and you may connect with two-dimensional X-ray detector 5.

[0106] As explained above, the X-ray CT scanner equipment of this invention There is no gantry. Only according to the structure where the scanning X line source and the two-dimensional X-ray detector are connected by the base material It becomes possible to undergo an operation, checking the condition of having been given by operation, if it is the patient on whom sufficient tooth space for the perimeter of the methods of three of the berth which carried analyte, or the methods of four is born, for example, analyte performs an operation without moving put on an operating table.

[0107] Moreover, the projection data obtained is three-dimension data, and the tomogram for desired can be displayed only by specifying a slice location. In this three-dimension data, if the slice cut surface of the include angle of arbitration is specified, not only a vertical slice cut surface but the tomogram for the include angle for which it asks can also be seen to analyte.

[0108] Furthermore, not only a vertical slice cut surface but an include angle can photo the tomogram for the slice cut surface of the slant set up freely to analyte in a short time by specifying the starting position of a slice cut surface, a termination location, i.e., the starting position of X wire element of a scanning X line source, and a termination location, and the starting position and termination location of a detector of a two-dimensional X-ray detector by the directions section on the screen of a display, and performing a fault image pick-up.

[0109] Although the above operation gestalt was explained, the following invention is also included in this description.

[0110] (1) The scanning X line source in which the X-ray radiant point which emits an X-ray is prepared possible [a two-dimensional scan], The two-dimensional X-ray detection means which is arranged so that analyte may be made to intervene between said scanning X line sources, it may be installed and the X-ray radial plane of said X-ray radiant point may be countered and in which a two-dimensional scan is possible, The scan control means made to scan so that sequential radiation

of the X-ray may be carried out from the X line each radiant point of said scanning X line source, X-ray CT scanner equipment with which said two-dimensional X-ray detection means is equipped with a data collection means to collect the detected projection data one by one, and a tomogram generation means to calculate the tomogram data of a three dimension from said collected projection data, and to generate the tomogram for a desired slice location.

[0111] (2) They are installed in a relative location, said scanning X line source and said two-dimensional X-ray detector given in the aforementioned (1) term countering.

[0112] (3) Said scanning X line source and said two-dimensional X-ray detector given in the aforementioned (1) term are connected with the character type of KO by the base material, and are fixed to it.

[0113] (4) Inclination movable ** of a parallel displacement and arbitration is possible for them, said scanning X line source and said two-dimensional X-ray detector given in the aforementioned (1) term maintaining the physical relationship which counters.

[0114] (5) Said two-dimensional X-ray detector of a publication becomes the aforementioned (1) term from the detector of at least two-line two trains.

[0115] (6) X-ray CT scanner equipment equipped with the data collection circuit which is attached in the scanning X line source in which a two-dimensional scan is possible, and the insertion section of an endoscope, and collects the projection data detected in the inside of analyte by the movable two-dimensional X-ray detector, the 1st control circuit which controls the scan of said scanning X line source, and said two-dimensional X-ray detector, and a tomogram generation means to generate the tomogram for a desired slice location from collected data.

[0116] (7) With the scanning X line source in which a two-dimensional scan is possible, the 1st two-dimensional X-ray detector which counters said scanning X line source and is installed, and the projection data which it was attached in the insertion section of an endoscope and the 1st two-dimensional X-ray detector detected The 2nd movable two-dimensional X-ray detector which can recognize an existence-within analyte location, and the direction of X-ray emission, The 1st control circuit which controls the scan of said scanning X line source, and the data collection circuit which collects the projection data detected by said 1st and/or 2nd two-dimensional X-ray detector, X-ray CT scanner equipment equipped with a tomogram generation means to generate the tomogram for a desired slice location from collected projection data.

[0117] (8) The scanning X line source in which a two-dimensional scan is possible, and the two-dimensional X-ray detector which counters said scanning X line source and is installed, The control circuit which controls the scan of said scanning X line source, and selection of a two-dimensional X-ray detector so that the scanning line of said scanned scanning X line source and the selection line of the detector with which said two-dimensional X-ray detector was chosen become parallel, X-ray CT scanner equipment equipped with the data collection circuit which

collects the projection data detected by said selected two-dimensional X-ray detector, and a means to obtain the tomogram for a desired slice location from collected data.

[0118] (9) X-ray CT scanner equipment equipped with the scanning X line source in which a two-dimensional scan is possible, the two-dimensional X-ray detector which counters said scanning X line source and is installed, the control circuit which controls the scan of said scanning X line source, the data collection circuit which collects the projection data detected by said two-dimensional X-ray detector, and the arithmetic circuit which carries out the function operation of the collected data.

[0119] (10) Said arithmetic circuit given in the aforementioned (9) term consists of subtraction arithmetic circuits.

[0120] (11) It has the scanning X line source and two-dimensional X-ray detector which countered the edge of the arm of C mold respectively and were formed in it and in which a two-dimensional scan is possible, the control circuit which controls the scan of said scanning X line source, the data collection circuit which collects the projection data detected by said two-dimensional X-ray detector, and a means to obtain the tomogram for a desired slice location from collected data.

[0121] (12) Said C type given in the aforementioned (11) term of arm is the character type arm configuration of KO which fixes a scanning X line source and a two-dimensional X-ray detector to the location which counters.

[0122] (13) The scanning X line source in which a two-dimensional scan is possible, and the control circuit which carries said scanning X line source, is carried in a stand equipped with the axle-pin rake for migration, and said stand, and controls the scan of said scanning X line source, The two-dimensional X-ray detector fixed to the stanchion which can move by the crookedness fixed to said stand, X-ray CT scanner equipment equipped with the monitor which is carried in said stand, is carried in the data collection circuit which collects the projection data detected by said two-dimensional X-ray detector, and said stand, and displays the generated tomogram.

[0123] (14) As for said scanning X line source and said two-dimensional X-ray detector given in the aforementioned (13) term, adjustable is possible for a relative location.

[0124] (15) Said X-ray detector given in the aforementioned (13) term is formed in the insertion section of an endoscope.

[0125] (16) The detector which changes into a signal the X-ray which carried out incidence arranges said X-ray detector given in the aforementioned (13) term in at least two-line two trains.

[0126] (17) X-ray-CT scanner equipment equipped with the scanning X line source in which a two-dimensional scan is possible, the probe which countered said scanning X line source and was equipped with the two-dimensional X-ray detector which can be installed, the 1st control circuit which controls the scan of said scanning X line source, the data collection circuit which collects the projection data detected by the two-dimensional X-ray detector, and a means generate the tomogram

for a desired slice location from collected data.

[0127] (18) The scanning X line source in which a two-dimensional scan is possible, and the 1st two-dimensional X-ray detector which counters said scanning X line source and is installed, The 2nd two-dimensional X-ray detector in which the X-ray from said scanning X line source was attached by the probe which can move freely within limits with incidence possible in which, X-ray CT scanner equipment equipped with the control circuit which controls the scan of said scanning X line source, the data collection circuit which collects the projection data detected by the 1st and/or 2nd two-dimensional X-ray detector, and a means to generate the tomogram for a desired slice location from collected data.

[0128] (19) The location and the direction of X-ray emission over analyte of a two-dimensional X-ray detector of the 2nd are detected by the projection data of the 1st two-dimensional X detector given in the aforementioned (18) term.

[0129] (20) The scanning X line source in which a two-dimensional scan is possible, and the 1st two-dimensional X-ray detector which counters said scanning X line source and is installed, The 2nd two-dimensional X-ray detector which installs the X-ray emitted from said scanning X line source movable within limits with incidence possible in which, The control circuit which carries out scan control of the X-ray emission from said scanning X line source, and the data collection circuit which collects the 1st and 2nd projection data detected by the 1st and 2nd two-dimensional X-ray detectors, The image field whose the 2nd projection data and spatial position correspond within the 1st projection data is X-ray CT scanner equipment equipped with a means to use the 2nd projection data and to generate the tomogram for a desired slice location.

[0130] (21) From the 1st projection data detected by the 1st two-dimensional X-ray detector given in the aforementioned (20) term, the radiation direction of the location and X-ray to the analyte of the 2nd two-dimensional X-ray detector is detected.

[0131] (22) The 2nd two-dimensional X-ray detector given in the aforementioned (20) term is formed in a surface probe.

[0132] (23) The 2nd two-dimensional X-ray detector given in the aforementioned (20) term is formed in the insertion section of an endoscope.

[0133] (24) The scanning X line source in which a two-dimensional scan is possible, and the two-dimensional X-ray detector which counters said scanning X line source and is installed, A field setting-out means to set up the range of a desired area of interest, and the control circuit which controls the scanning zone of said scanning X line source according to said area of interest, The selection circuitry which chooses the range of the detector which detects in said two-dimensional X-ray detector according to said area of interest, X-ray CT scanner equipment equipped with a means to generate the tomogram for a desired slice location, from the data collection circuit which collects the projection data which said detector detected, and collected data.

[0134] (25) Said scanning X line source given in the above (1), (6), (7), (8), (9), (11), (13), (17), (18), (20), and (24) terms emits a flabellate form or a conic X-ray.

[0135] (26) Said two-dimensional X-ray detector given in the aforementioned (1) term consists of a scintillator installed in the image pick-up side of a solid state image pickup device and this solid state image pickup device.

[0136]

[Effect of the Invention] As explained in full detail above, the tomogram for a direction which photos and asks without migration of analyte for the fault data of the three dimension of an area of interest can be obtained abandoning a gantry, having sufficient tooth space for the perimeter of analyte, and processing to a test subject according to this invention, and the X-ray CT scanner equipment which can check the present condition can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing showing the rough example of a configuration of the 1st operation gestalt of X-ray CT scanner equipment according [drawing 1 (a)] to this invention and drawing 1 (b) are drawings showing the example of the three-dimension data obtained by X-ray CT scanner equipment.

[Drawing 2] It is a flow chart for explaining the tomography by the X-ray CT scanner equipment shown in drawing 1 .

[Drawing 3] It is drawing for explaining generation of the tomogram by the X-ray CT scanner equipment of the 1st operation gestalt.

[Drawing 4] It is drawing for explaining the tomography of the random scan which sets up the slice location by the X-ray CT scanner equipment of the 2nd operation gestalt.

[Drawing 5] It is a flow chart for explaining the tomography of the random scan by the X-ray CT scanner equipment shown in drawing 4 .

[Drawing 6]It is drawing for explaining the tomography showing the amount of aging by the X-ray CT scanner equipment of the 3rd operation gestalt.

[Drawing 7] It is a flow chart for explaining the tomography by the X-ray CT scanner equipment shown in drawing 6 .

[Drawing 8] It is the flow chart of the subroutine explaining the two-dimensional scan shown in drawing 7 .

[Drawing 9]It is drawing for explaining the tomography which scans the spatial range of the magnitude of the arbitration by the X-ray CT scanner equipment of the 4th operation gestalt.

[Drawing 10] It is a flow chart for explaining the tomography by the X-ray CT scanner equipment shown in drawing 9 .

[Drawing 11]It is drawing showing the example of a configuration of the scanning X line source as X-ray CT scanner equipment of the 5th operation gestalt, and a two-dimensional X-ray detector.

[Drawing 12]It is drawing showing the example of a configuration carried in the movable stand as X-ray CT scanner equipment of the 6th operation gestalt.

[Drawing 13]It is drawing showing the example of a configuration equipped with one scanning X line source and two two-dimensional X-ray detectors as X-ray CT scanner equipment of the 7th operation gestalt.

[Drawing 14] It is a flow chart for explaining the tomography by the X-ray CT scanner equipment shown in drawing 13 .

[Drawing 15] It is the flow chart of the subroutine explaining the data selection which chooses the tomogram shown in drawing 14 .

[Drawing 16]It is drawing showing the example of a configuration equipped with two scanning X line sources and one two-dimensional X-ray detector as X-ray CT scanner equipment of the 8th operation gestalt.

[Drawing 17]It is drawing for explaining the tomography by the 2nd scanning X line source attached in the endoscope in the 6th operation gestalt.

[Drawing 18]It is drawing showing the example of a configuration of a movable base material in each in the condition of having made the scanning X line source and two-dimensional X-ray detector in the X-ray CT scanner equipment shown in drawing 1 countering.

[Description of Notations]

1 -- X wire element (X-ray radiant point)

2 -- Scanning X line source

3 -- Scan control section

4 -- Detector

5 -- Two-dimensional X-ray detector

6 -- Driver section

7 -- Amplifier

8 -- A/D converter

9 -- Data collection section

10 -- Operation part

11 -- Analyte

12 -- Display

13 -- Printer

14 -- Control section

15 -- Directions section

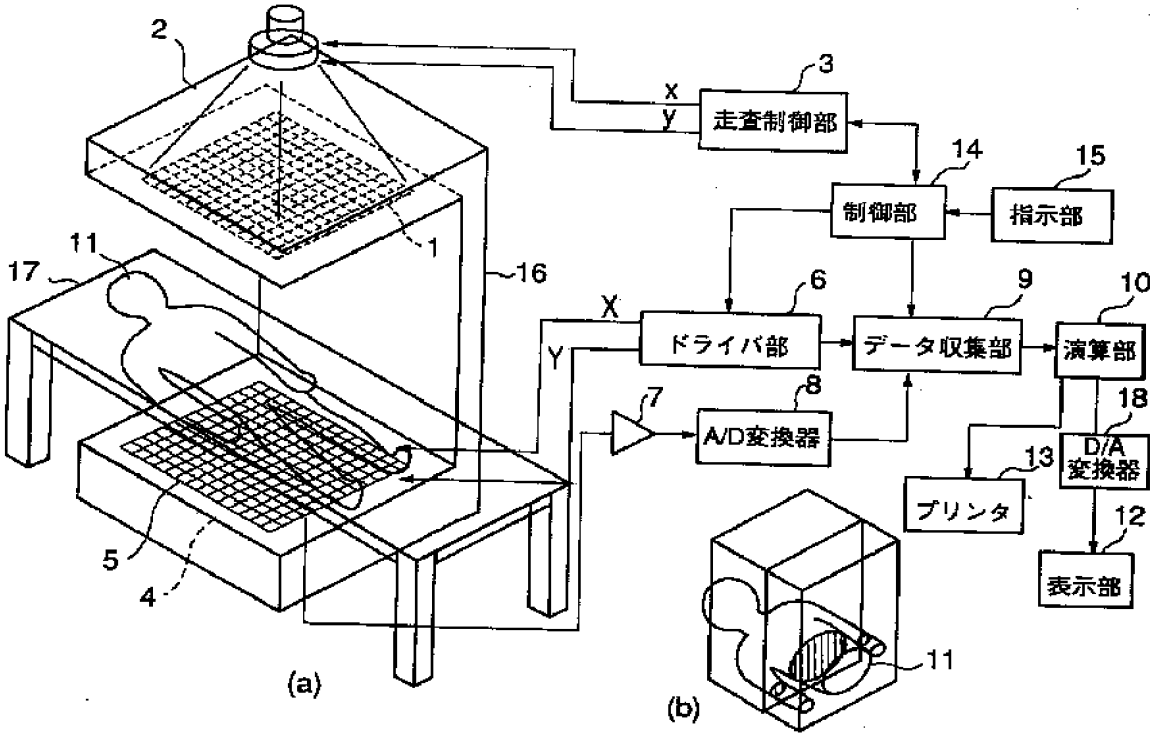
16 -- Base material

17 -- Berth

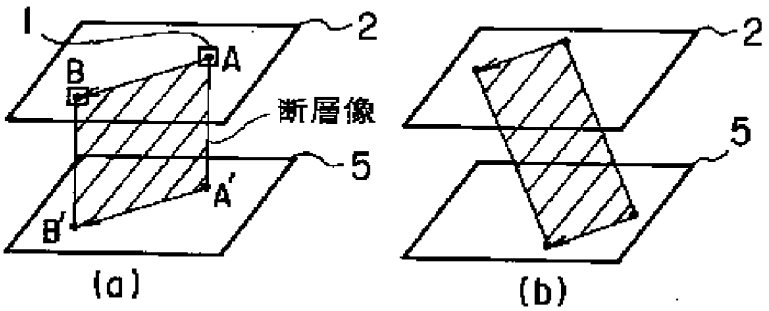
[Translation done.]

DRAWINGS

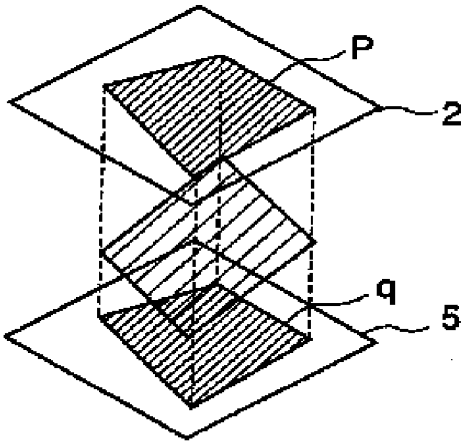
[Drawing 1]



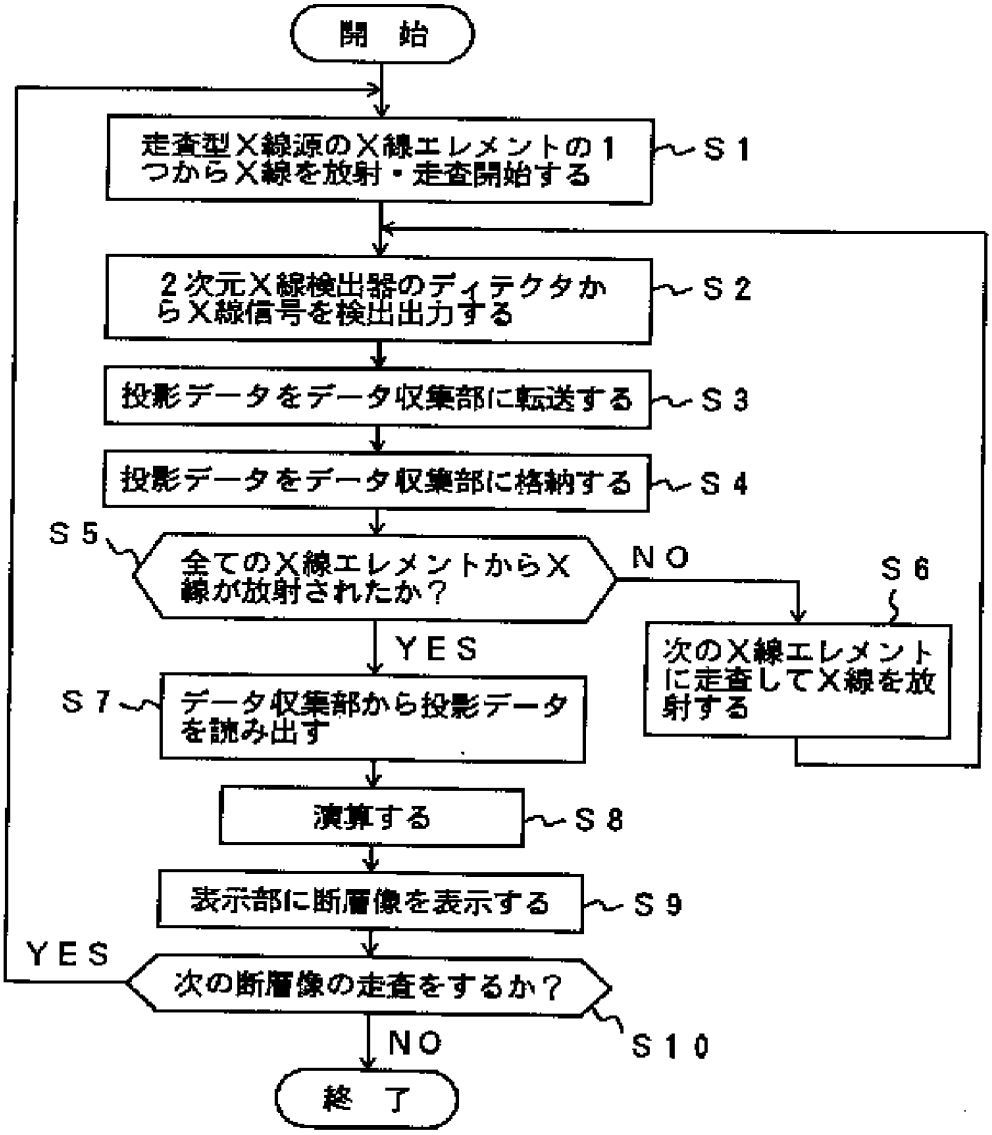
[Drawing 4]



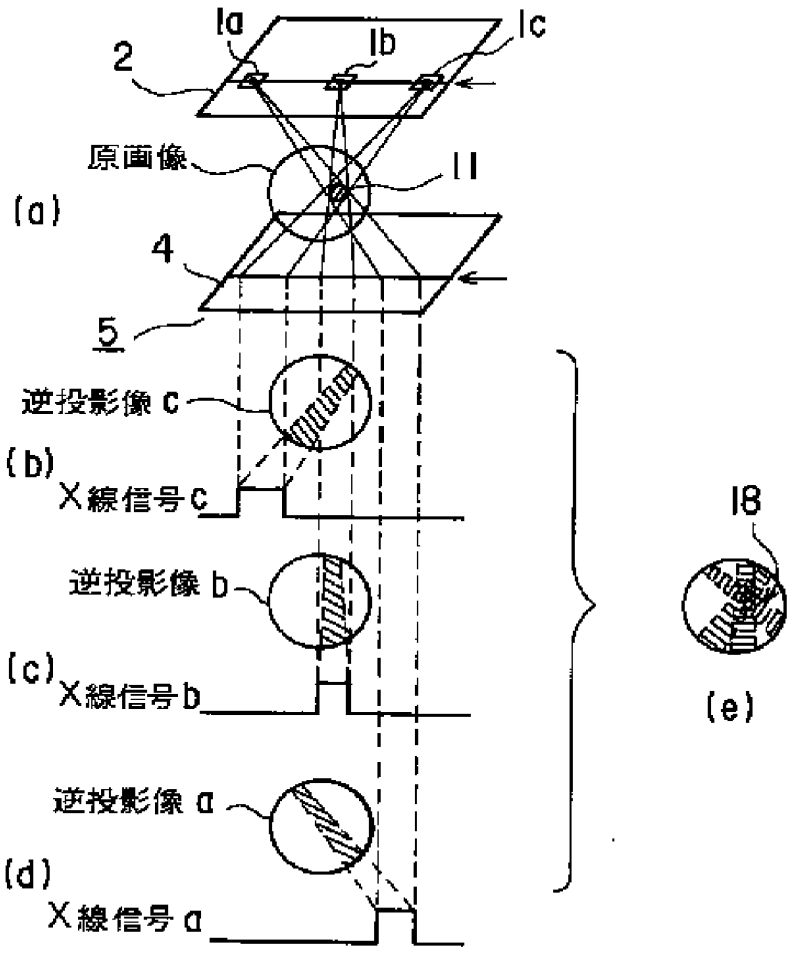
[Drawing 9]



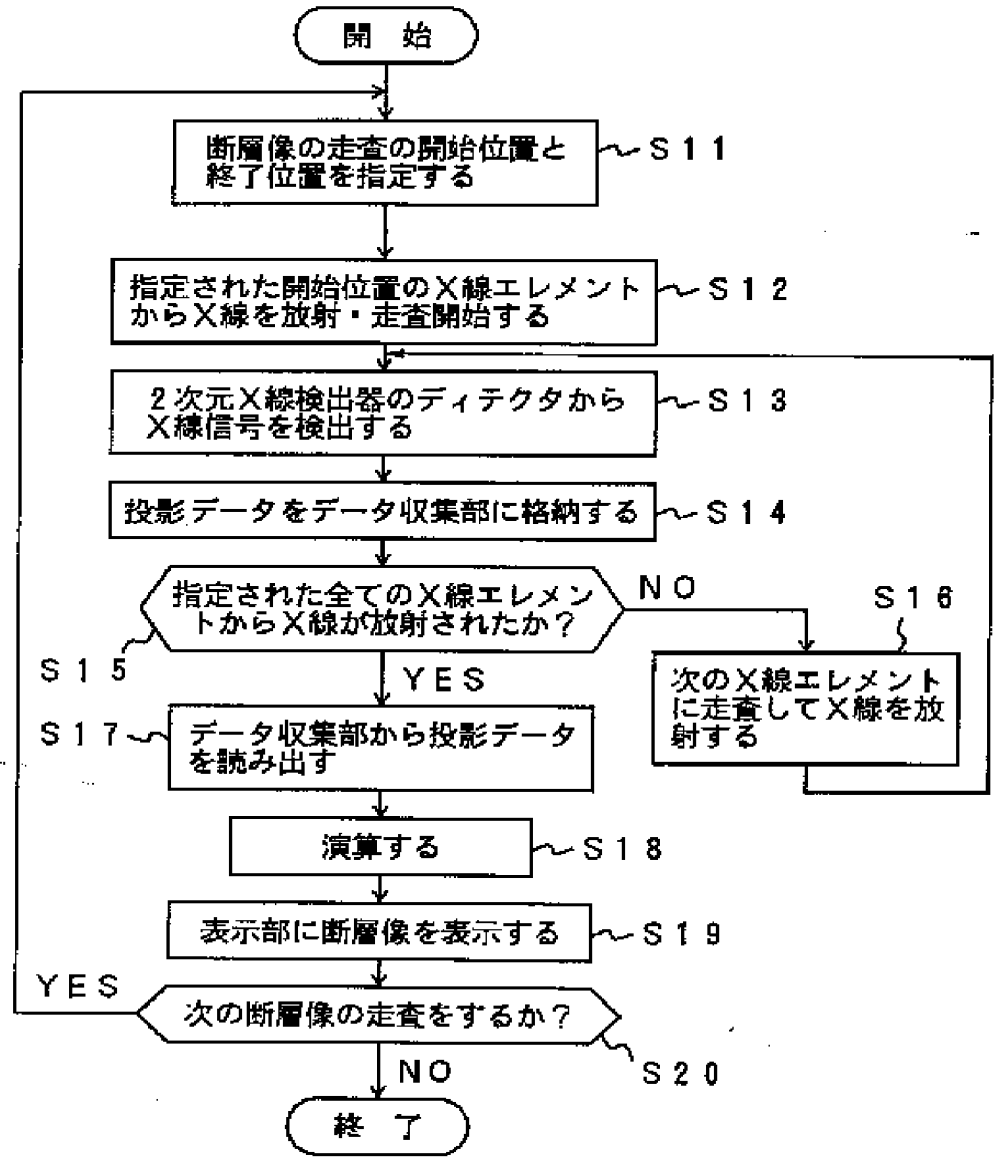
[Drawing 2]


開　始
走査型X線源のX線エレメントの1つからX線を放射・走査開始する
S1
2次元X線検出器のディテクタからX線信号を検出出力する
S2
投影データをデータ収集部に転送する
S3
投影データをデータ収集部に格納する
S4
S5
全てのX線エレメントからX線が放射されたか？
NO
S6
次のX線エレメントに走査してX線を放射する
YES
S7
データ収集部から投影データを読み出す
演算する
S8
表示部に断層像を表示する
S9
YES
次の断層像の走査をするか？
S10
NO
終　了

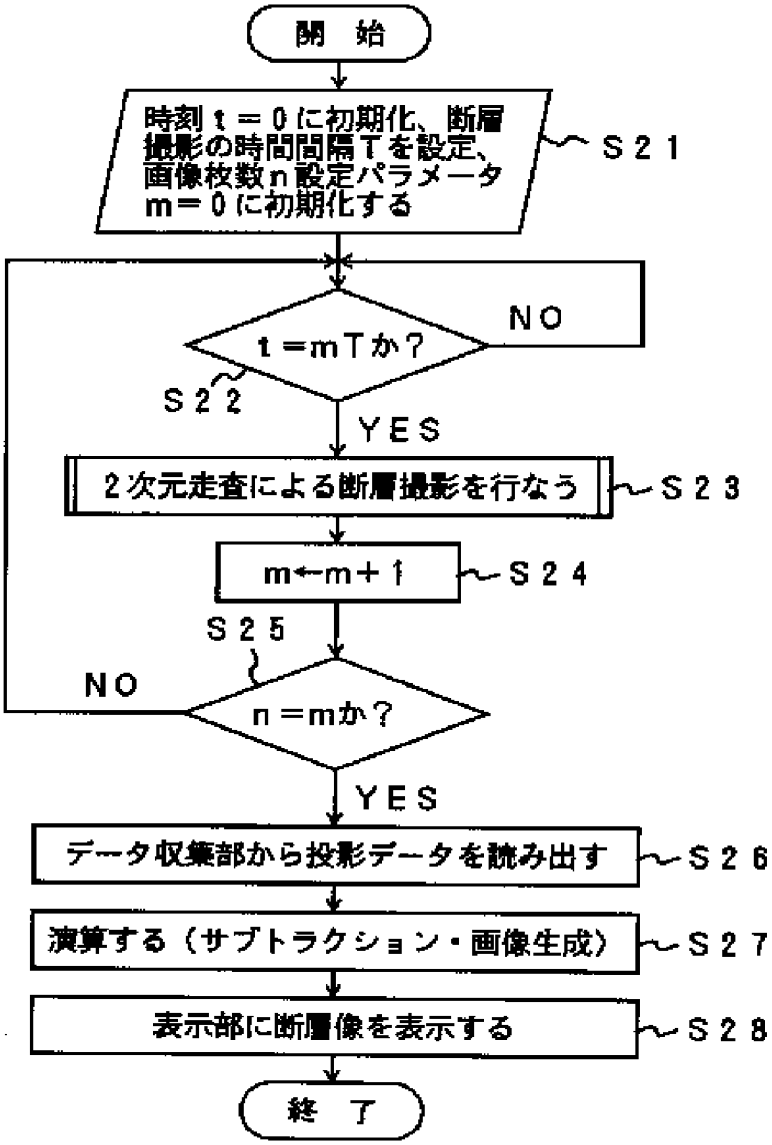
[Drawing 3]


1a
1b
1c
2
原画像
11
(a)
4
5
逆投影像 c
(b)
X線信号 c
逆投影像 b
(c)
X線信号 b
逆投影像 a
(d)
X線信号 a
18
(e)

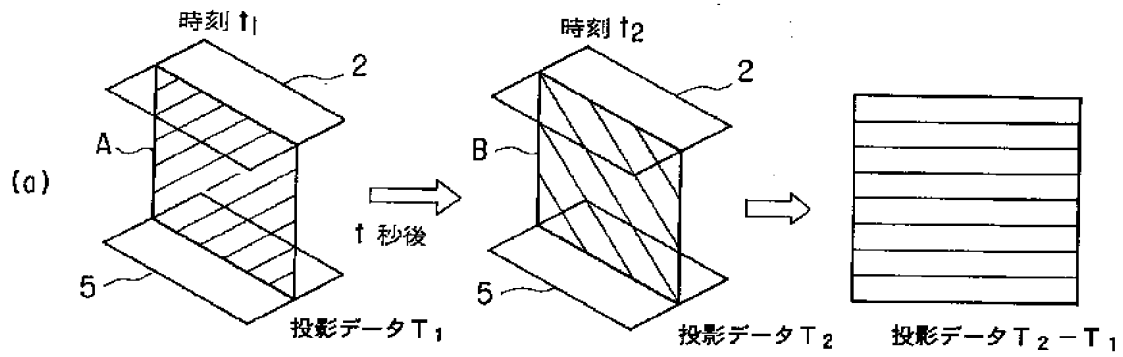
[Drawing 5]


開　始
断層像の走査の開始位置と終了位置を指定する
S１１
指定された開始位置のX線エレメントからX線を放射・走査開始する
S１２
2次元X線検出器のディテクタからX線信号を検出する
S１３
投影データをデータ収集部に格納する
S１４
指定された全てのX線エレメントからX線が放射されたか？
S１５
NO
S１６
YES
次のX線エレメントに走査してX線を放射する
S１７
データ収集部から投影データを読み出す
演算する
S１８
表示部に断層像を表示する
S１９
YES
次の断層像の走査をするか？
S２０
NO
終　了

[Drawing 7]


開　始
時刻ｔ＝０に初期化、断層撮影の時間間隔Ｔを設定、画像枚数ｎ設定パラメータｍ＝０に初期化する
Ｓ２１
ｔ＝ｍＴか？
ＮＯ
Ｓ２２
ＹＥＳ
２次元走査による断層撮影を行なう
Ｓ２３
ｍ←ｍ＋１
Ｓ２４
Ｓ２５
ＮＯ
ｎ＝ｍか？
ＹＥＳ
データ収集部から投影データを読み出す
Ｓ２６
演算する（サブトラクション・画像生成）
Ｓ２７
表示部に断層像を表示する
Ｓ２８
終　了

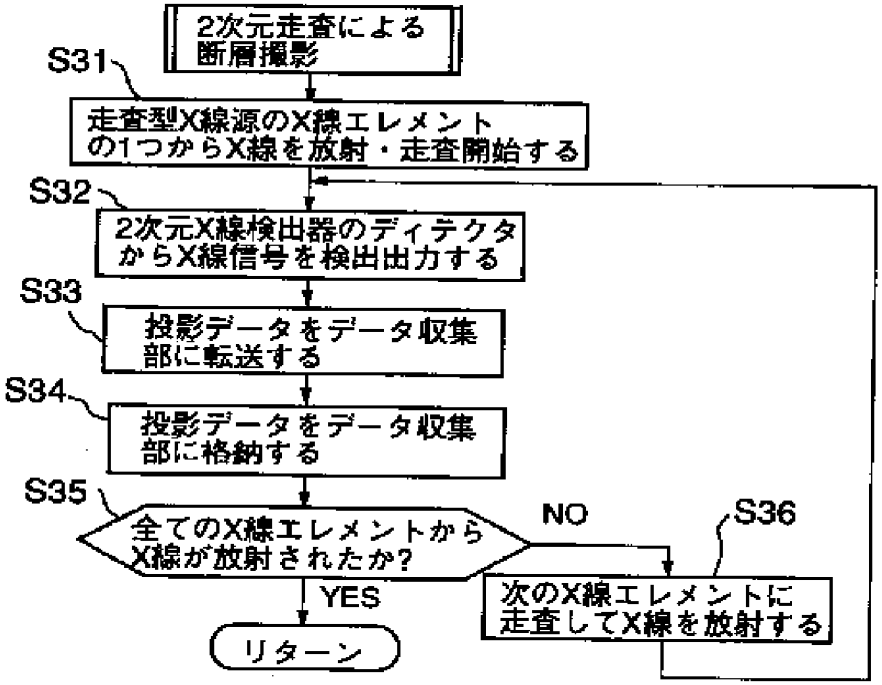
[Drawing 6]



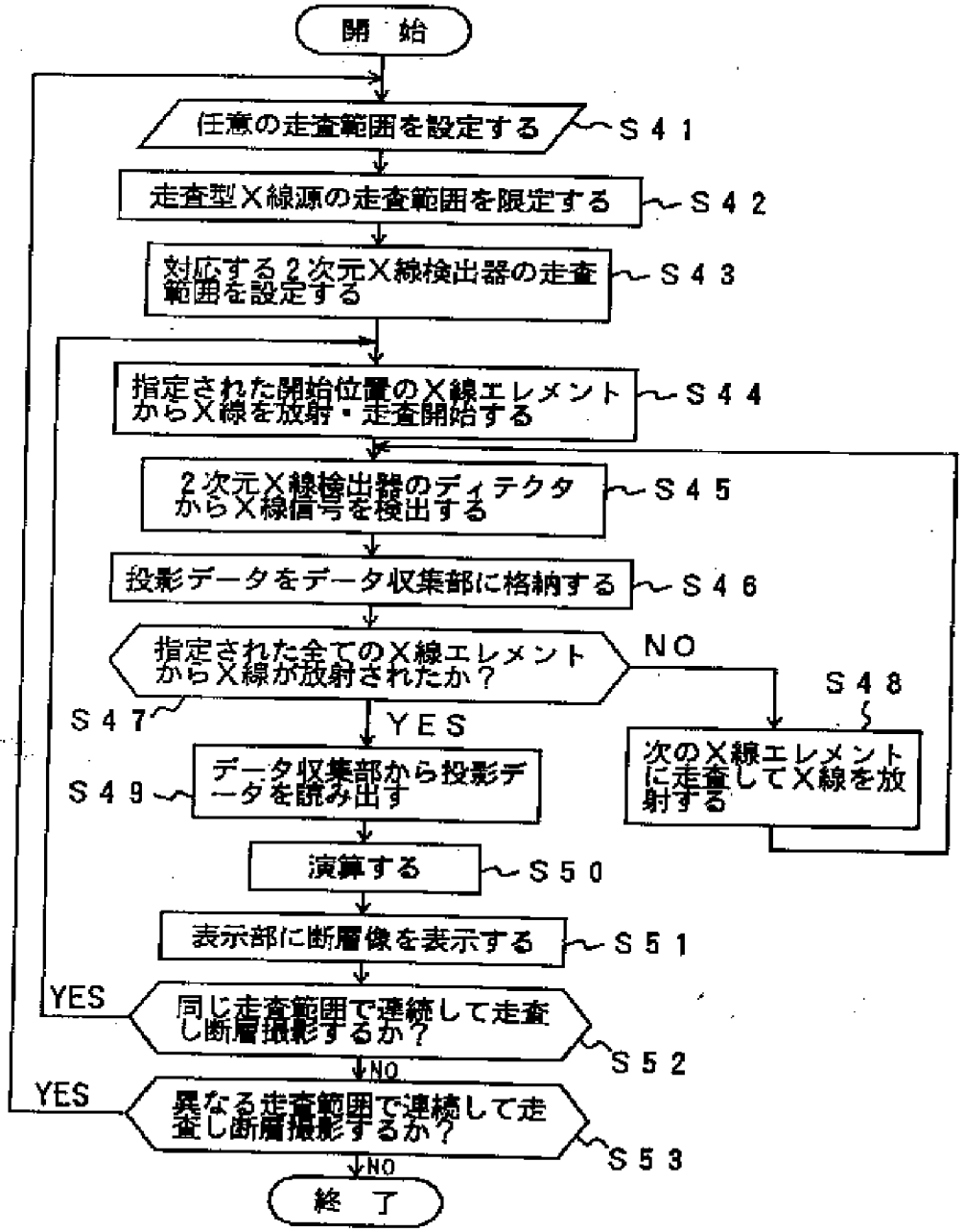
(b)

走査型X線源		2次元 X線検出器		投影データ	
x	y	X	Y	T_1	T_2
⋮	⋮	⋮	⋮	⋮	⋮

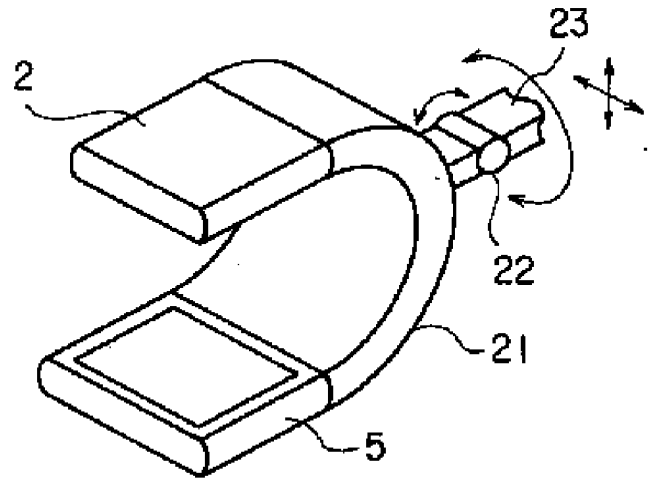
[Drawing 8]



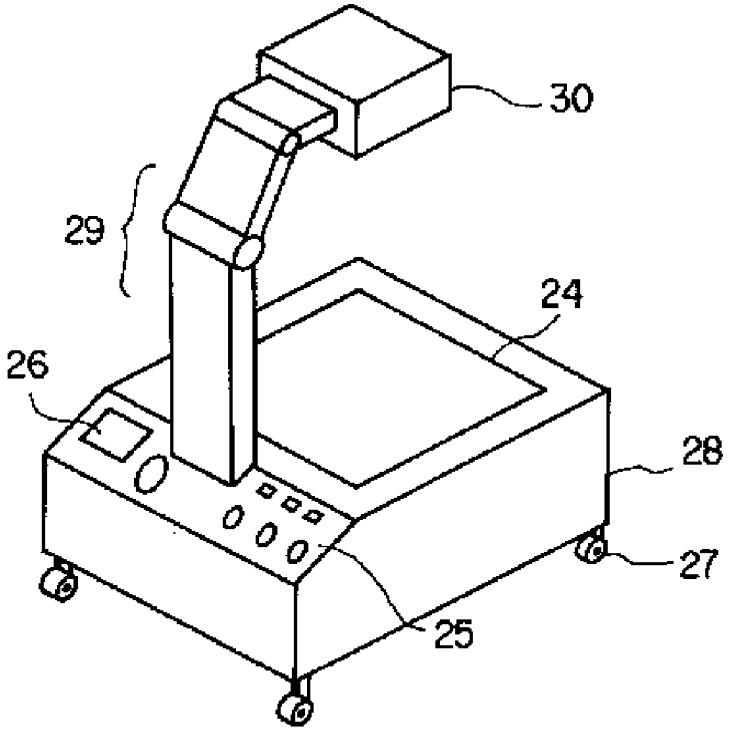
[Drawing 10]


開　始
任意の走査範囲を設定する
S41
走査型X線源の走査範囲を限定する
S42
対応する2次元X線検出器の走査範囲を設定する
S43
指定された開始位置のX線エレメントからX線を放射・走査開始する
S44
2次元X線検出器のディテクタからX線信号を検出する
S45
投影データをデータ収集部に格納する
S46
指定された全てのX線エレメントからX線が放射されたか？
NO
S48
次のX線エレメントに走査してX線を放射する
S47
YES
S49
データ収集部から投影データを読み出す
演算する
S50
表示部に断層像を表示する
S51
YES
同じ走査範囲で連続して走査し断層撮影するか？
S52
NO
YES
異なる走査範囲で連続して走査し断層撮影するか？
S53
NO
終　了

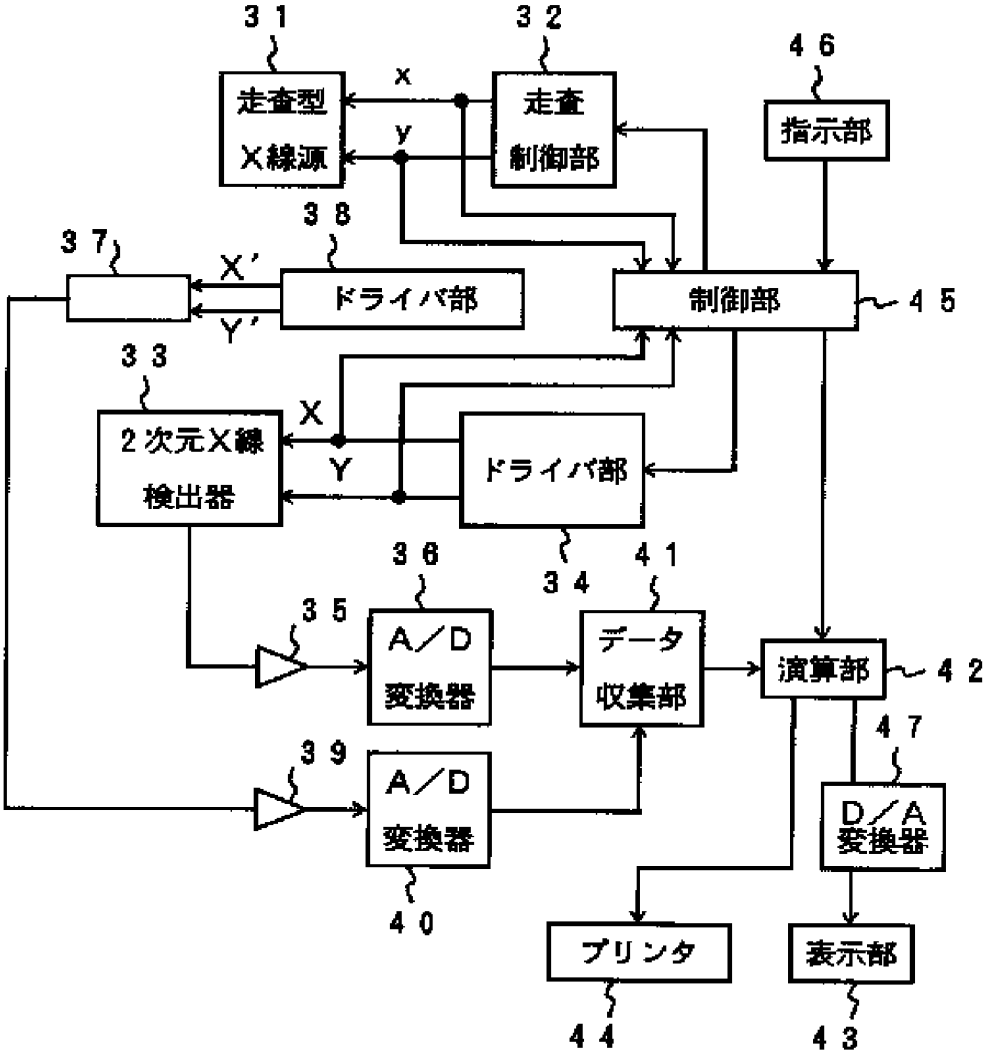
[Drawing 11]



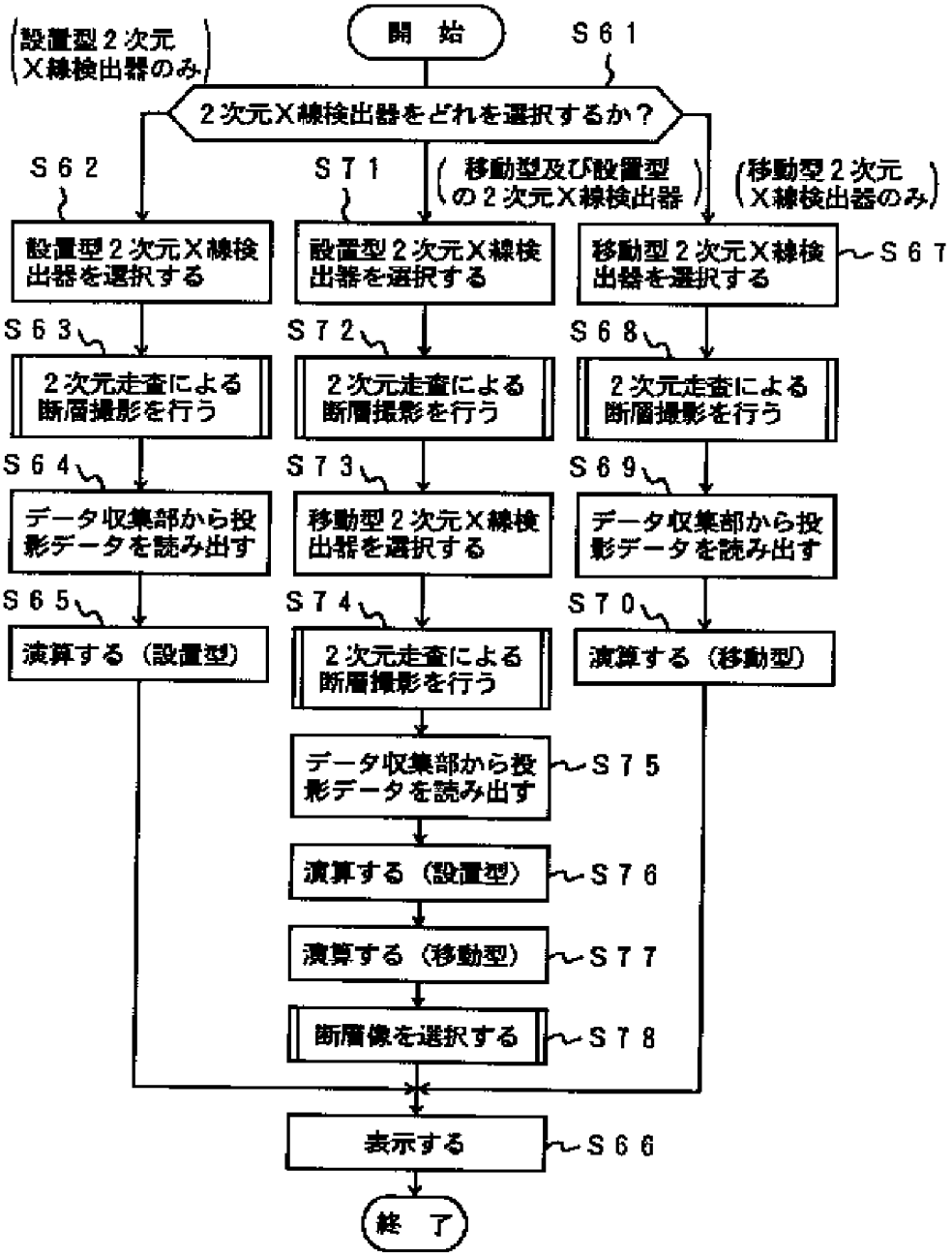
[Drawing 12]



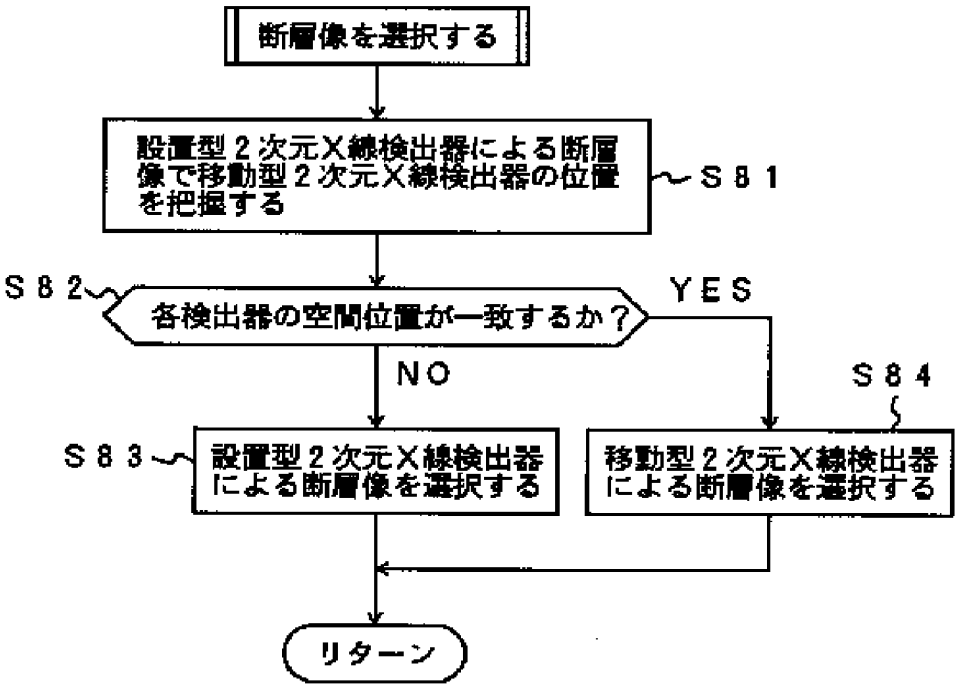
[Drawing 13]


31
32
46
走査型
X線源
x
y
走査
制御部
指示部
38
37
X'
Y'
ドライバ部
制御部
45
33
2次元X線
検出器
X
Y
ドライバ部
34
36
41
35
A／D
変換器
データ
収集部
演算部
42
47
39
A／D
変換器
D／A
変換器
40
プリンタ
表示部
44
43

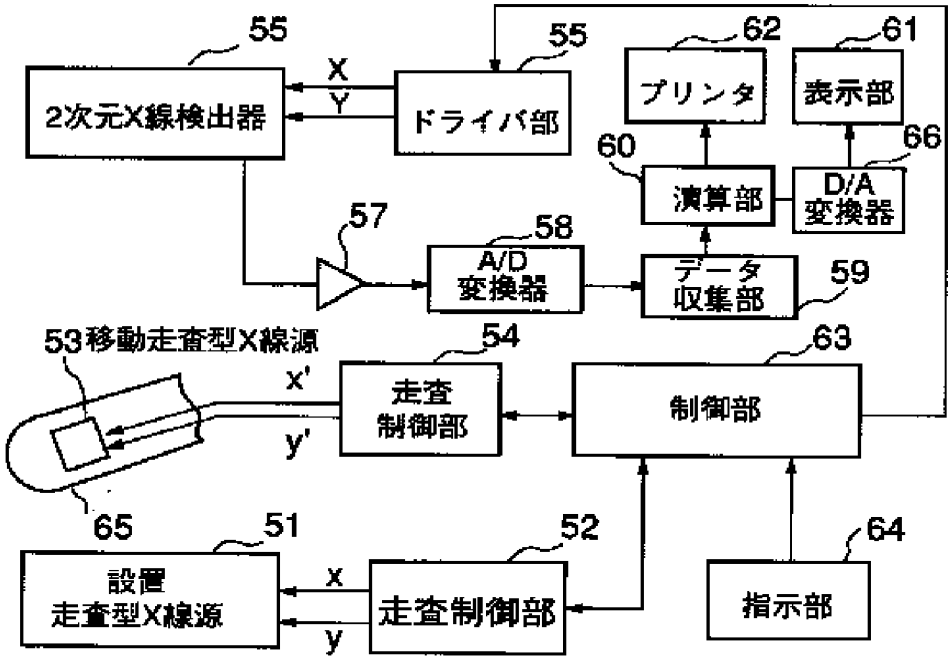
[Drawing 14]


開　始
S61
2次元X線検出器をどれを選択するか？
設置型2次元X線検出器のみ
S62
S71
移動型及び設置型の2次元X線検出器
移動型2次元X線検出器のみ
設置型2次元X線検出器を選択する
設置型2次元X線検出器を選択する
移動型2次元X線検出器を選択する
S67
S63
S72
S68
2次元走査による断層撮影を行う
2次元走査による断層撮影を行う
2次元走査による断層撮影を行う
S64
S73
S69
データ収集部から投影データを読み出す
移動型2次元X線検出器を選択する
データ収集部から投影データを読み出す
S65
S74
S70
演算する（設置型）
2次元走査による断層撮影を行う
演算する（移動型）
データ収集部から投影データを読み出す
S75
演算する（設置型）
S76
演算する（移動型）
S77
断層像を選択する
S78
表示する
S66
終　了

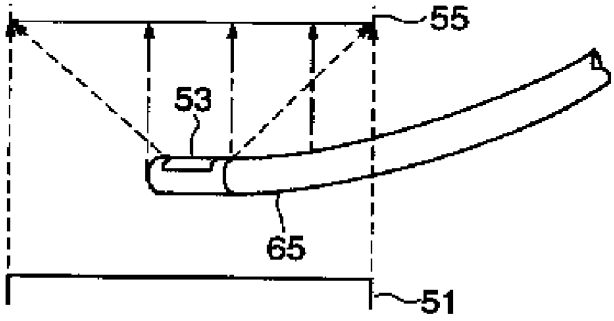
[Drawing 15]


断層像を選択する
設置型２次元Ｘ線検出器による断層像で移動型２次元Ｘ線検出器の位置を把握する
Ｓ８１
Ｓ８２
各検出器の空間位置が一致するか？
ＹＥＳ
ＮＯ
Ｓ８４
Ｓ８３
設置型２次元Ｘ線検出器による断層像を選択する
移動型２次元Ｘ線検出器による断層像を選択する
リターン

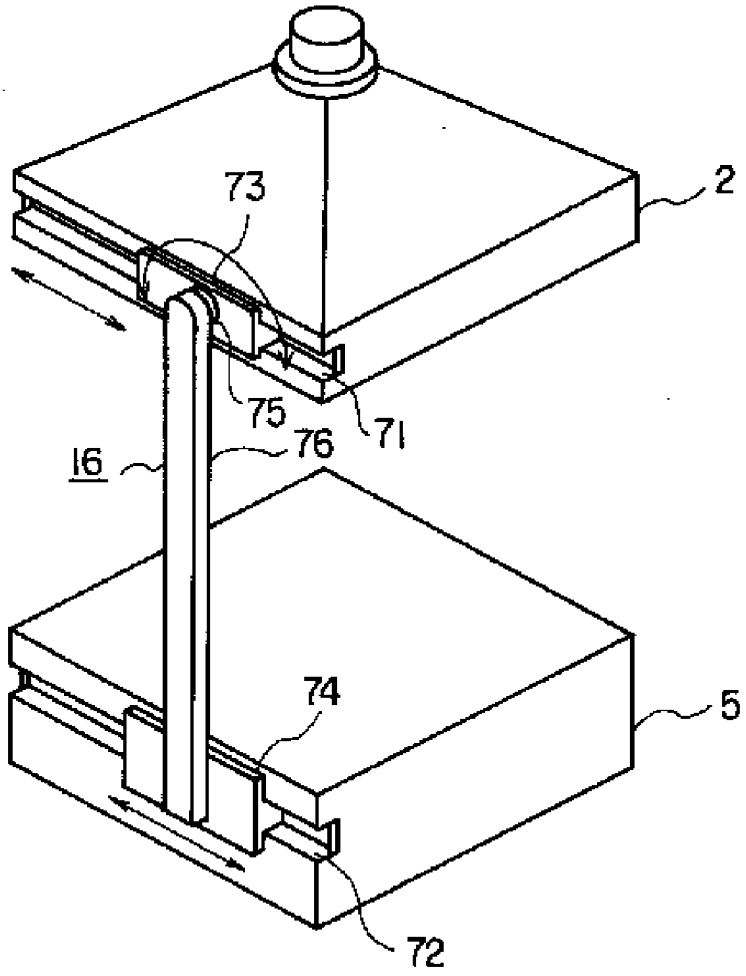
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]